Name: Ige Ayodeji Oluwasegun
Dept: Civil Engineering
Matric No: 19/ENG05/014

PHY102 Assignment

4questions

3)a) (i) Volume charge density

$\rho = \frac{dq}{dv} \longrightarrow dQ = \rho dv$

(ii) Surface charge density

$\sigma = \frac{dQ}{dA} \longrightarrow dQ = \sigma dA$

(iii) linear charge density

$\lambda = \frac{dQ}{dL} \longrightarrow dQ = \lambda dL$

b) $dW = F \cdot dL$

$F = -q_0 E$

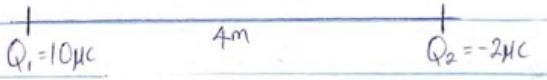
$dW = -q_0 E dL$

$W(A \rightarrow B)_{Ag} = -q_0 \int_A^B E dL$

$V_B - V_A = \frac{W(A \rightarrow B)_{Ag}}{q_0}$ it follows the definition.

$V_B - V_A = -\int_A^B E dL$

c)



$Q_1 = 10\mu C \quad Q_2 = -2\mu C$

$V = \frac{1}{4\pi\varepsilon_0}\left[\frac{Q_1}{r_1} \times \frac{Q_2}{r_2}\right]$

$\frac{0}{9\times10^9} = \frac{10\times10^{-6}}{r_1} - \frac{2\times10^{-6}}{r_2}$

$2r_1 = 10r_2, \quad r_1 = 5r_2$

Refering to the diagram above, the position along the x-axis where ✓ r 0 is 5m from $Q_1 = 10\mu C$ and 1m from $Q_2 = -2\mu C$

4)a) Magnetic flux is defined as the stength of the magnetic field which can be represented by line of forces. It is represented by the Symbol Φ mathematically given as $\Phi = B \cdot dA$

b) $m = 9.11 \times 10^{-31} kg$ $r = 14 \times 10^{-7} m$ $B = 3.5 \times 10^{-1} weber/m^2$

Cyclotron frequency = angular speed

$$w = \frac{v}{r} = \frac{qB}{m}$$

$$w = \frac{qB}{m} = \frac{1.6 \times 10^{-19} \times 35 \times 10^{-1}}{9 \times 10^{-31}} = 62222.2222 T^{-1}$$

c) We were given Parameter such as.

(i) mass of the electron = $9.11 \times 10^{-3} kg$.

(ii) A radius of $1.4 \times 10^{-7} m$

(iii) Magnetic field of 3.5×10^{-1} weber/m^2

We were asked to find the Cyclotron frequency which is equal Or the same thing as angular speed. It is called Cyclotron frequency because it is a frequency of an accelerator called cyclotron. Recall That angular speed is given as $w =$ substituting we have

$w = 1.6 \times 10^{\wedge}-19 \times 3.5 \times 10^{\wedge}-10 / 9 \times 10^{\wedge}-31$

$= 62222.2222 T^{-1}$

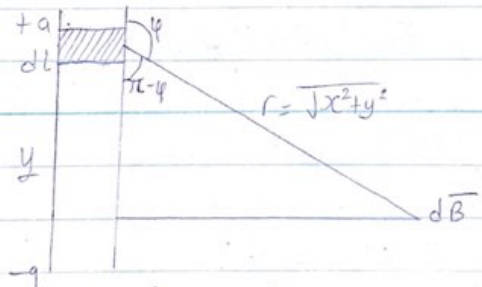
5) a) Biot savart law is an equation that describes the magnetic field created by a current-carrying wire, and allows you to calculate its strength at various points... And we replace the electric field E with a magnetic field element dB because a moving charge produces a magnetic field not an electric field.

Permeability of freespace — length of segment — radical direction — distance

$$B = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{s} \times \hat{r}}{r^2}$$

$$\mu_0 = 4\pi \times 10^{-7}\ T \cdot m/A$$

b) Section of a straight current carrying conductor



$$B = \frac{\mu_0 I}{4\pi x}\left(\frac{2a}{(x^2+a^2)^{1/2}}\right)$$

When the length 2a of the conductor is very great in comparison to distance x from point P, we consider it infinitely long. That is with a is much large than x,

$$(x^2 + a^2)^{1/2} \cong a \text{ as } a \to \infty$$

$$B = \frac{\mu_0 I}{2\pi x}$$

In a physical situation, we have axial symmetry about y-axis. Thus at all points in a circle of radius r, around the conductor, the magnitude of B is

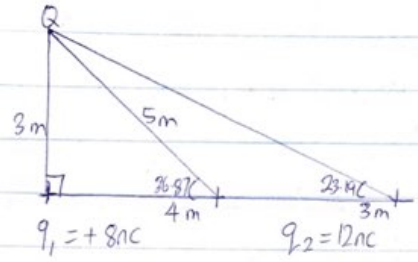
$$B = \frac{\mu_0 I}{2\pi r} \quad \ldots (1)$$

Equation (1) defines the magnitude of the magnetic field of flux density B near a long, straight current carrying conductor.

2a) Electric field: It is a region of space in which an electric charge will experience an electric force.

Electric field intensity: It can be defined as the force per unit charge $E = \frac{F(N)}{q_0(C)}$

b)



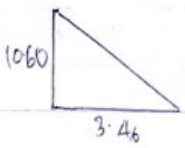
(i) $E_1 = \frac{kQ_1}{r^2} = \frac{9\times10^9\times8\times10^{-9}}{7^2} = 1.47$ + $= 13.47 N/C$

$E_2 = \frac{kQ_2}{r^2} = \frac{9\times10^9\times8\times10^{-9}}{3^2} = 12$

(ii) $E_1 = \frac{9\times10^9\times8\times10^{-9}}{9} = 8$

$E_2 = \frac{9\times10^9\times12\times10^{-9}}{5^2} = 4.32$

x	y
$8\times\cos(90)$	$8\times\sin 90$
$= 0$	8
$4.32\times\cos(36.87)$	$4.37\times\sin(36.87)$
$= 3.46$	2.60
3.46	10.60



$x = \sqrt{10.6^2 + 3.46^2} = 11.15 N/C$